REMARKS

Claims 15-27 and 56-78 are all the claims presently pending in the application. Claims 15, 21, 27 and 63-64 have been amended to more clearly define the claimed invention. Claims 76-78 have been added to claim additional features of the claimed invention.

It is noted that the claim amendments herein are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims, or for any statutory requirements of patentability.

Further, it is noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 15, 17, 27, 56, 60, 62-63, 65, 67 and 74-75 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Morshed ("Epitaxial CeO2 on silicon substrate... for SOI Structures"). Claims 21, 24, 58, 61, 64 and 66 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over in view of Reisman et al. (U.S. Patent No. 4,891,329). Claims 20 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Morshed in view of Reisman, further in view of Guenzer et al. (U. S. Patent No. 5,478,653). Claims 16 and 22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Morshed in view of Reisman, further in view of Wang et al. (U. S. Patent No. 6,376,337). Claims 18-19, 24-25 and 68-70 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Morshed in view of Reisman, further in view of Yano et al. (U.S. Patent No. 6,096,434). Claims 57 and 59 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Morshed in view of Reisman, further in view of Setsune et al. (U.S. Patent No. 4,980,339). Claims 71-73 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Morshed in view of Reisman, further in view of Ami et al. (U.S. Patent No. 6,610,548).

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed (e.g., see independent claim 15), is directed to a semiconductor structure which includes a substrate, a crystalline oxide layer including single-crystal oxide formed over the substrate, and a smooth epitaxial silicon layer including single-crystal silicon formed on the crystalline oxide layer.

In another aspect (e.g., as defined in claim 21), a semiconductor structure includes a substrate, a crystalline oxide layer including single-crystal oxide formed over the substrate, and a smooth epitaxial germanium layer including single-crystal germanium formed on the crystalline oxide layer.

In a third aspect (e.g., as defined in claim 27), a semiconductor structure includes a crystalline oxide surface including a single-crystal oxide surface, and an amorphous layer of at least one of silicon, germanium, gallium arsenide, aluminum arsenide, indium phosphide, aluminum antimonide, indium arsenide, gallium phosphide and mixed alloys thereof, deposited on the crystalline oxide surface by evaporation or chemical vapor deposition. Importantly, the amorphous layer is deposited in the presence of a surfactant vapor, such that the amorphous layer forms a smooth epitaxial silicon layer when annealed.

Conventional semiconductor structures include epitaxial silicon films formed on CeO_2. However, such structures have resulted in a silicon growth profile that is rough and three dimensional and, moreover, the silicon was not epitaxial in nature (Application at page 3, lines 12-19).

The claimed invention, on the other hand, includes a smooth epitaxial silicon layer (or epitaxial germanium layer, etc.) formed on a crystalline oxide layer (Application at page 16, lines 14-20). Thus, the claimed invention provides a more uniform and desirable structure than the conventional structure.

II. THE PRIOR ART REFERENCES

A. The Morshed Reference

The Examiner alleges that Morshed teaches the invention of claims 15, 17, 27, 56, 60, 62-

63, 65, 67 and 74-75. Applicant submits, however, that there are elements of the claimed invention that are not taught or suggested by Guenzer.

Morshed discloses a silicon layer formed on CeO_2. Importantly, the silicon growth profile is rough and three dimensional and, moreover, the silicon is not epitaxial (e.g., not completely epitaxial) in nature (Morshed at Abstract; Figure 5).

Thus, Morshed does not teach or suggest "*a smooth epitaxial silicon layer comprising single-crystal silicon formed on said crystalline oxide layer*", as recited in claim 15, or "*wherein said amorphous layer is deposited in the presence of a surfactant vapor, such that said amorphous layer forms a smooth epitaxial silicon layer when annealed*", as recited in claim 27.

As noted above, unlike conventional semiconductor structures which have a silicon growth profile that is rough and three dimensional and, the silicon is not epitaxial in nature, the claimed invention, includes a smooth epitaxial silicon layer (or epitaxial germanium layer, etc.) formed on a crystalline oxide layer (Application at page 16, lines 14-20). Thus, the claimed invention provides a more uniform and desirable structure than the conventional structure.

Clearly, these novel features are not taught or suggested by Morshed. Indeed, the Examiner attempts to rely on Figure 2, the Abstract and page 339 to support her position. However, nowhere in these passages or drawing does Morshed teach or suggest a smooth epitaxial silicon layer including single-crystal silicon formed on the crystalline oxide layer. Certainly, nowhere do these passages or drawing teach or suggest an amorphous layer deposited in the presence of a surfactant vapor, such that the amorphous layer forms a smooth epitaxial silicon layer when annealed.

In fact, Applicant would point out to the Examiner that Morshed is discussed in the Background section of the present Application (e.g., see page 3, lines 12-19). Specifically, the Application states that the Morshed structure resulted in a silicon growth profile that is rough and three dimensional. Moreover, unlike the claimed invention, the silicon was not epitaxial (e.g., completely epitaxial) in nature.

Thus, the present Application clearly recognizes the Morshed paper and clearly sets forth the differences between the rough Morshed structure, and the claimed invention which provides a

smooth epitaxial silicon layer. Applicant respectfully submits that the Examiner cannot reasonably ignore the plain language of the Application which clearly distinguishes the Morshed structure from the claimed invention.

Indeed, the Application states that in one exemplary embodiment, the solid phase epitaxy on the oxide surface may be carried out in the presence of a surfactant vapor (Application at page 5, lines 13-20). As a result, the surfactant alters the surface energy of the silicon (or other semiconductor), such that the silicon does not roughen as a result of the solid phase epitaxy.

That is, solid phase epitaxial growth of silicon typically results in a rough silicon surface (Application at page 15, lines 5-10). However, when the epitaxy is performed in the presence of a surfactant vapor, the epitaxial silicon layer has a smooth surface.

In fact, the formation of a rough surface is illustrated by Morshed. For example, Figure 5 in Morshed clearly illustrates a very rough surface, as described in the Background section of the Application. This is completely different than the claimed invention in which the epitaxial silicon layer may be smooth (e.g., and thin). For example, the smooth epitaxial layer in the claimed structure may have a roughness of less than 5Å (e.g., for an epitaxial silicon layer having a thickness of about 20Å-50Å). Clearly, such a smooth surface of epitaxial silicon is not contemplated by Morshed (e.g., compare Figure 5 of Morshed).

Further, nowhere does Morshed teach or suggest forming an amorphous layer (e.g., of silicon, germanium, etc.) in the presence of a surfactant vapor. Thus, Morshed certainly does not recognize at least one of the methods, that the Application states may be used to form a smooth epitaxial silicon layer.

Further, Applicant would point out that the silicon layer in Morshed is not entirely epitaxial. Indeed, Morshed clearly states that the silicon layer is only "mainly epitaxial" (Morshed at page 342). Figure 2 clearly illustrates that the silicon layer in Morshed is not competely epitaxial, but has large portions which are polycrystalline. That is, the silicon layer is not completely single crystal. Thus, the Morshed structure is completely different than the claimed structure.

Therefore, Applicant respectfully submits that Morshed does not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to

withdraw this rejection.

B. The Reisman Reference

The Examiner alleges that Morshed would have been combined with Reisman to form the claimed invention of claims 21, 23, 58, 61, 64 and 66. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Reisman discloses a method of forming a nonsilicon on insulator structure by forming a thin heteroepitaxial layer of nonsilicon semiconductor on a substrate having a lattice structure which allegedly matches that of the heteroepitaxial layer (Reisman at Abstract).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Specifically, Morshed is directed to a method of forming CeO_2 on silicon, whereas Reisman is merely directed to forming a nonsilicon on insulator structure. Therefore, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. In fact, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Morshed, nor Reisman, nor any combination thereof, teaches or suggests "*a smooth epitaxial germanium layer comprising single-crystal germanium formed on said crystalline oxide layer*", as recited in claim 21.

As noted above, unlike conventional semiconductor structures which have a silicon growth profile that is rough and three dimensional and, the silicon is not epitaxial in nature, the claimed invention, includes a smooth epitaxial silicon layer (or epitaxial germanium layer, etc.)

formed on a crystalline oxide layer (Application at page 16, lines 14-20). Thus, the claimed invention provides a more uniform and desirable structure than the conventional structure.

Clearly, these novel features are not taught or suggested by Reisman. Indeed, nowhere does the Examiner even allege that this feature is taught or suggested by Reisman. That is, the Examiner concedes that Reisman does not teach or suggest a smooth epitaxial germanium layer.

In particular, the Examiner attempts to rely on Reisman as allegedly teaching a thin layer of epitaxial non-silicon semiconductor formed on a crystalline layer (Figure 1C). However, even assuming (arguendo) that Reisman suggests an epitaxial germanium layer, nowhere does Reisman teach or suggest **a smooth** epitaxial germanium layer formed on a crystalline oxide layer.

Therefore, Reisman clearly does not make up for the deficiencies of Morshed.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

C. The Wang Reference

The Examiner alleges that Morshed would have been combined with Reisman and that the alleged Morshed/Reisman combination would have been further combined with Wang to form the claimed invention of claims 21, 23, 58, 61, 64 and 66. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Wang discloses a method of forming an epitaxial silicon oxide layer between epitaxial silicon (Wang at Abstract).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Specifically, in contrast to Morshed and Reisman, Wang is is directed to a method of forming a silicon oxide layer. Therefore, Wang is completely unrelated to the other references,

and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. In fact, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Morshed, nor Reisman, nor Wang, nor any combination thereof, teaches or suggests "*a smooth epitaxial germanium layer comprising single-crystal germanium formed on said crystalline oxide layer*", as recited in claim 21.

Clearly, these novel features are not taught or suggested by Wang. Indeed, nowhere does the Examiner even allege that this feature is taught or suggested by Wang.

The Examiner attempts to rely on Wang as allegedly teaching additional layers of crystalline oxide.

Clearly, nowhere does Wang teach or suggest a smooth epitaxial germanium layer formed on a crystalline oxide layer. Therefore, Wang clearly does not make up for the deficiencies of Morshed and Reisman.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

D. The Guenzer Reference

The Examiner alleges that Morshed would have been combined with Reisman and that the alleged Morshed/Reisman combination would have been further combined with Guenzer to form the claimed invention of claims 16 and 22. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Guenzer discloses a bismuth titanate (BTO) layer allegedly used as a template layer for growth of crystallographically-oriented silicon. Specifically, Guenzer discloses an underlying layer of BTO which is polycrystalline (Guenzer at col. 1, lines 50-57).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Specifically, in contrast to Morshed and Reisman, Guenzer is directed to a method of forming a silicon layer on bismuth titanate. Therefore, Guenzer is completely unrelated to the other references, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. In fact, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Thus, neither Morshed, nor Reisman, nor Guenzer, nor any combination thereof teaches or suggests "*a smooth epitaxial silicon layer comprising single-crystal silicon formed on said crystalline oxide layer*", as recited in claim 15, or "*a smooth epitaxial germanium layer comprising single-crystal germanium formed on said crystalline oxide layer*", as recited in claim 21.

Clearly, these novel features are not taught or suggested by Guenzer. Indeed, the Examiner merely relies on Guenzer as allegedly teaching a silicon oxide layer formed between a substrate and a crystalline oxide layer.

However, even assuming, arguendo, that Guenzer discloses such a silicon oxide layer, Guenzer clearly does not teach or suggest a smooth epitaxial silicon layer incluging single-crystal silicon formed on a crystalline oxide layer, or a smooth epitaxial germanium layer including single-crystal germanium formed on a crystalline oxide layer.

Therefore, Applicant respectfully submits that these references would not have been

combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

E. The Yano Reference

The Examiner alleges that Morshed would have been combined with Reisman and that the alleged Morshed/Reisman combination would have been further combined with Yano to form the claimed invention of claims 18-19, 24-25 and 68-70. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Yano discloses a conductive oxide thin film formed on a substrate having a silicon (100) face at its surface. Specifically, Yano teaches that the conductive oxide thin film may be a zirconate with a rare earth component.

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Specifically, in contrast to Morshed and Reisman, Yano is directed to a method of forming a conductive oxide thin film formed on a substrate. Therefore, Yano is completely unrelated to the other references, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. In fact, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Thus, neither Morshed, nor Reisman, nor Yano, nor any combination thereof teaches or suggests "*a smooth epitaxial silicon layer comprising single-crystal silicon formed on said crystalline oxide layer*", as recited in claim 15, or "*a smooth epitaxial germanium layer*

comprising single-crystal germanium formed on said crystalline oxide layer", as recited in claim 21.

Clearly, these novel features are not taught or suggested by Yano. Indeed, the Examiner attempts to rely on Yano merely as allogedly teaching an oxide layer including a mixture of rare earth oxides or different rare earth elements.

However, even assuming, arguendo, that Yano discloses such a mixture, Yano clearly does not teach or suggest a smooth epitaxial silicon layer incluging single-crystal silicon formed on a crystalline oxide layer, or a smooth epitaxial germanium layer including single-crystal germanium formed on a crystalline oxide layer.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

F. The Setsune Reference

The Examiner alleges that Morshed would have been combined with Reisman and that the alleged Morshed/Reisman combination would have been further combined with Setsune to form the claimed invention of claims 57 and 59 Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Setsune discloses a superconductor structure which includes a coating layer formed by mixing either Ba, Sr, Ca, Be, Mg or ZrO_2 with a rare earth element (Setsune at col. 1, lines 39-57).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. In fact, contrary to the Examiner's allegations, neither of these references teach or suggest their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Thus, neither Morshed, nor Reisman, nor Setsune, nor any combination thereof teaches or suggests "*a smooth epitaxial silicon layer comprising single-crystal silicon formed on said crystalline oxide layer*", as recited in claim 15, or "*a smooth epitaxial germanium layer comprising single-crystal germanium formed on said crystalline oxide layer*", as recited in claim 21.

Clearly, these novel features are not taught or suggested by Setsune. Indeed, the Examiner attempts to rely on Setsune merely as allogedly teaching a germanium substrate.

However, even assuming, arguendo, that Setsune discloses such a substrate, Setsune clearly does not teach or suggest a smooth epitaxial silicon layer incluging single-crystal silicon formed on a crystalline oxide layer, or a smooth epitaxial germanium layer including single-crystal germanium formed on a crystalline oxide layer.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

G. The Ami Reference

The Examiner alleges that Morshed would have been combined with Reisman and that the alleged Morshed/Reisman combination would have been further combined with Ami to form the claimed invention of claims 71-73Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Ami discloses method of forming a ferroelectric non-volatile memory (Ami at Abstract).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. In fact, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Thus, neither Morshed, nor Reisman, nor Ami, nor any combination thereof teaches or suggests "*a smooth epitaxial silicon layer comprising single-crystal silicon formed on said crystalline oxide layer*", as recited in claim 15, or "*a smooth epitaxial germanium layer comprising single-crystal germanium formed on said crystalline oxide layer*", as recited in claim 21.

Clearly, these novel features are not taught or suggested by Ami. Indeed, the Examiner attempts to rely on Setsune merely as allogedly teaching a bixbyite structure.

However, even assuming, arguendo, that Ami discloses such a bixbyite structure, Ami clearly does not teach or suggest a smooth epitaxial silicon layer incluging single-crystal silicon formed on a crystalline oxide layer, or a smooth epitaxial germanium layer including single-crystal germanium formed on a crystalline oxide layer.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 15-27 and 56-78, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to

discuss any other changes deemed necessary in a telephonic or personal interview

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Assignee's Deposit Account No. 50-0510.

Respectfully Submitted,

Date: 8/5/04

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that the foregoing Amendment was filed by facsimile with the United States Patent and Trademark Office, Examiner Theresa T. Doan, Group Art Unit # 2814 at fax number (703) 872-9306 this 5th day of August, 2004.

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